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Information on efficiency as an aspect of self-regulation in university departments

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Introduction

Birnbaum (1988) defines the academic organisation and its leadership within the context of a cybernetic institution. Birnbaum's theoretical model was based on a dynamic and nonlinear open system and first-order cybernetic regulatory processes. The main idea of cybernetic regulation is based on constructing dynamic loops in which the element of a system affects the environment, which in turn affects the system. This interactive dynamic between a system and its environment may lead to an amplifying or stabilising process. The process begins when some change in the external or internal environment leads to an organisational response that alters the value of some variable. If that variable is being monitored by some formal or informal group (a sensing unit), and if that change of value moves it beyond acceptable limits, the group will attempt to influence the administration (or some other controlling unit) to change the organisation's response until the variable moves back into an acceptable range.

In the Finnish context, Hölttä (see Hölttä 1995; Hölttä & Nuotio 1995; Hölttä & Karjalainen 1997) has also studied both Birnbaum's cybernetic institutional management model and self-regulation. According to Hölttä and

Karjalainen (1997), the system of the flexible workload of university teachers was based on the idea of creating stabilising, self-correcting cybernetic control loops into the management system. The most important issue in creating self-regulating control loops is that this information – which is usually most confidential and sensitive to individuals – is fed back to academic departments and heads of departments, with no involvement from administrators in its interpretation.

My doctoral dissertation (Näppilä 2012) examined the theoretical information on efficiency as part of researcher's and teacher's self-regulation in university departments. Successful self-regulation requires information on efficiency, in other words, the optimal use of resources. This kind of information is information for researchers and teachers, not for their managers or administrators. It is also important to know what skills, values, technologies and knowledge individual researchers and teachers will undertake in their work. I utilised new theoretical assumptions from systems theories (autopoiesis, self-organisation) and second-order cybernetics. My contribution to the existing theory was that individual self-regulation with information on efficiency was taken into account. This theoretical modification will help in re-thinking the ideas of self-regulation at universities.

The cybernetics of academic organisation and leadership

According to Birnbaum (1988), open systems are dynamic and nonlinear. System parts are themselves systems; they constantly change as they interact with themselves and with the environment, and the system evolves over time. Both people and colleges exist as part of an open system. They interact with other elements of those systems and the environment in which they are imbedded. Structural (rules, regulations, structures) and social (interaction of individuals in groups) controls are organisational feedback loops which are sensitive to selected factors in the environment. Negative feedback loops provide information that something is wrong. They allow systems to sense when some important variable is outside its acceptable limits (that is, outside the organisation's constraint set) and attempt to correct it.

A thermostat is an example of a self-correcting, cybernetic control system with a feedback loop. It turns the furnace on when the temperature of the environment falls below the pre-set limit and turns it off when the temperature returns to the desired level. This keeps the temperature within an acceptable range. The cybernetic process is depicted as a causal loop. The process begins when some change in the external or internal environment leads to an organisational response that alters the value of some variable. If that variable is being monitored by some formal or informal group (a sensing unit), and that change of value moves it beyond acceptable limits, the group will attempt to influence the administration (or some other controlling unit) to change the organisation's response until the variable moves back into an acceptable range (Birnbaum 1988).

According to Birnbaum (1988), in a cybernetic system, an organisation's subsystems respond to the limited number of inputs (students, money and knowledge) to monitor their operation and make corrections and adjustments as necessary; organisational responses are not based on measuring or improving their output (educated students, knowledge and skilled labour). This is possible when systems create feedback loops that tell them when thing are going wrong. Systems receive several and different kinds of inputs from the environment, transforming them in some way, and then return them to the environment. Outputs do not disappear (as they do in closed systems) but return to the environment, where they may again become inputs (alumni).

The main idea behind cybernetic regulation is based on constructing dynamic loops in which the element of a system affects the environment, which in turn affects the system. This interactive dynamic between a system and its environment may lead to an amplifying or stabilising process (Birnbaum 1988, 47–51). Cybernetic systems can function effectively only if environmental disturbances are sensed and negative feedback is then generated by organisational subunits that monitor these data (1988, 197). If the increase in the cause variable increases the value of the affected variable, which in turn increases the value of the original cause variable, the process is called positive feedback. The target of university management in this system setting is the opposite: to introduce self-correcting or stabilising processes. If one element or sub-system is unbalanced by an external impulse, the built-in mechanisms of the system stabilise it and balance returns between the system elements and the sub-system. This is called negative feedback (1988, 181–183).

The open systems view suggests that we should always organise with the environment in mind (see Morgan 1998, 42). The organisation is typically viewed as an open system in constant interaction with its environment, transforming inputs into outputs as a means of creating the conditions necessary for survival. Changes in the environment are viewed as presenting challenges, to which the organisation must respond (1998, 215). Thus, to self-regulate, learning systems must be able to sense, monitor and scan significant aspects of their environment, relate this information to the operating norms that guide system behaviour, detect significant deviations from these norms and initiate corrective action when discrepancies are detected (1998, 77). Regarding the cybernetics of observed systems we may consider to be first-order cybernetics, the observer enters the system by stipulating the system's purpose. We may call this a "first-order stipulation" (von Foerster 1979, 2).

Creating self-regulating control loops and information systems

The University of Joensuu initiated a management reform in the late 1980s as a response to the new national higher education steering policy and reform of the public sector. The university was also driven to find its competitive advantage as a result of the increased competition for funding within the education sector as well as to attract motivated students and excellent personnel. The initial solution was characterised by a radical decentralisation of decision-making and responsibility to academic departments. Real executive power was also transferred to individual academic leaders, especially to the rector and heads of departments from the collegial councils, which were seen to be too slow and inefficient in the new environment (see Hölttä & Karjalainen 1997).

According to Hölttä and Karjalainen (1997), the system of flexible workload of university teachers was based on the idea of creating stabilising, self-correcting cybernetic control loops into the management system and building black boxes of hierarchical order at different levels of the organisation, while respecting disciplinary values and diversity of leadership cultures in an academic organisation. The most important issue in creating self-regulating control loops is that this information—which is usually most confidential and sensitive to individuals—is fed back to academic departments and heads of departments, with no involvement from administrators in its interpretation.

The confidentiality of information production has been seen as essential because costs and outcomes can be assessed only within the department. Sometimes, high unit costs are deliberate and are a consequence of planning. For example, a teacher may be developing a new course and prepares supplementary material for students, or the study module in basic education may be offered only to a small number of students who might later require a certain specialisation at the post-graduate level. No expertise exists outside the department to interpret this detailed cost and output information (Hölttä & Karjalainen 1997).

Information system

The system produces information about the allocation of labour costs, even individual teachers and different institutional functions, and—within education—different study modules. This information is available in the system, which is aggregated at each organisational level, but the logic of hierarchical black boxes is followed. The most detailed information concerning individuals is available at the level of basic units only, and aggregated information on the whole department and teacher categories—professors, associate professors, lecturers, etc.—is produced for the use of deans of faculties and the rector of the university (Hölttä & Karjalainen 1997, 232–233).

The integrated structure of the information systems allows a combination of output information with cost information. For each study module or course, the number of students who passed, as well as credits performed, can be combined with the corresponding cost information, and the system calculates the unit costs for any desired level of aggregation—from a single module and individual to the level of the educational function and the university. This information is aimed especially at encouraging self-evaluation within departments as well as the assessment of costs and outcomes so as to support the next planning cycle within the departments (Hölttä & Karjalainen 1997, 232–233).

Policy barriers to individual learning processes and autonomy

In general, budgets and other management controls often maintain single-loop learning by monitoring expenditures, sales, profits and other indicators of performance to ensure that organisational activities remain within established limits. Especially bureaucratised organisations have fundamental organising principles that actually obstruct the learning process. Bureaucratisation tends to create fragmented patterns of thought and action. Situations in which policies and operating standards are challenged tend to be exceptions rather than the rule. Under these circumstances, single-loop learning systems are reinforced and may actually serve to keep an organisation on the wrong course (Morgan 1998, 79–81).

Within the Finnish higher education system, several barriers and policies worked to prevent the autonomy of university units and their academics, including external (Ministry of Education) and internal (heads of departments, deans and rectors) controlling and steering (output-oriented degrees, publications, funding principles) and external and internal (managerial) supervision and (administrative) bureaucracy (personnel liability to practice cost accounting, to monitor their working hours and to report their performances) (see Kuoppala, Näppilä, & Hölttä 2010).

Theoretical assumptions of new cybernetics and system theories

Autopoiesis

An autopoietic system "grows" and maintains itself by reference to itself. It uses a self-referential circular process in a system of continuous self-making (Glanville 2008; Maturana & Varela 1980). "I" is the shortest self-referential loop. One creates oneself by creating oneself. "I" is the operator, who is the result of the operation (von Foerster 2003, 304). An autopoietic system is stable through its (dynamic) ability to keep on making itself anew (Glanville 2008). The basic goal of an organism's behaviour is to maintain its own organisation, its identity, which enables the system to emerge (Brier 2008).

According to von Glasersfeld (2002, based on Maturanas work), autopoietic systems are closed homeostatic systems with no input or output. The term "closure" is intended to indicate that the equilibrium of the autopoietic system may be perturbed from the outside, but there is no input or output of "information"; its actions are in the service of its homeostasis (inner equilibrium). Cognition as a process is constitutively linked to the organisation and structure of the cognising agent. What a cognitive organism comes to know is necessarily shaped by the concepts it has constructed (von Glasersfeld 2002, 13–14).

The theory of autopoiesis accepts that systems can be recognised as having "environments", but insists that relations with any environment are internally determined (Maturana & Varela 1980). A living system responds to its environment in ways determined by its autopoiesis. It constructs its environment through the domain of interactions made possible by its autopoietic organisation. A living system operates within the boundaries of an organisation that closes in on itself and leaves the world on the outside (see Vanderstraeten 2001, 299).

Self-organising

"Intelligence organizes the world by organizing itself" (Piaget 1937, 311) and intelligence evolves (Morgan 1998, 86). According to Prigogine (1980; Prigogine & Stengers 1984), the self-organising system is in a constant state of chaos and order, i.e. it alternates between consecutive overlapping cycles of chaos and order and order and chaos. After organising itself and being driven into chaos, it re-organises and subsequently comes under threat and is driven into disorder, etc. In systems that are capable of self-organisation, entropy is necessary and indispensable. Entropy introduces uncertainty, imbalance and confusion into the system, and it is this very instability that gives the system its capacity for self-organisation (Glandsdorff & Prigogine 1971). It is the self-questioning ability that underpins the activities of the system that enables it to learn ("double-loop" learning) and self-organise (see Morgan 1998, 78–79).

Concerning dynamic, self-organising systems, Kauffman (1995; 2000) emphasises spontaneous and diversified networks, self-selection, self-oriented activity, self-interest and build-in purpose. According to Kauffman, living systems (autonomous agents) live on the edge-of-chaos. To renew themselves, these autonomous agents actively seek new opportunities and try to utilise these opportunities. Spontaneous and diversified networks will create possibilities for self-renewal. This self-interest should be balanced with the environment. Otherwise, spontaneous cooperation with the environment would be impossible.

Second-order cybernetics

In comparison to second-order cybernetics, first-order cybernetics may be seen as a limited case whereby the link from observed to observer is sufficiently weakened (or ignored). Under such circumstances, we assume that the observer simply observes what is going on, neutrally and unmoved, instead of changing behaviour in response to the observed. In second-order cybernetics, circularity becomes central, and a subject becomes its own object (or subject!). Control is circular, and the controller and controlled are roles determined by an observer. Second-order cybernetics is developed when the understandings developed in cybernetics are applied to the subject itself, thus enhancing the subject. Self-reference is at the heart of second-order cybernetics and brings with it autonomy and identity (Glanville 2008).

The constructivist theory of knowing, one of the cornerstones of second-order cybernetics can be briefly summarised in the principle: Knowledge is the result of a cognitive agent's active construction. Its purpose is not the representation of an external reality, but the generation and maintenance of the organism's equilibrium. The value of knowledge cannot be tested by comparison with such an independent reality, but must be established by its viability in the world of experience (von Glasersfeld 2002).

In a "second-order stipulation", the observer enters the system by stipulating his own purpose. Social cybernetics must be a form of second-order cybernetics so that the observer who enters the system shall be allowed to stipulate his own purpose: he is autonomous. If we fail to do so, someone else will determine a purpose for us. Moreover, if we fail to do so, we shall provide excuses for those who want to transfer responsibility for their own actions to another. Finally, if we fail to recognise everyone's autonomy, we may turn into a society that attempts to honour commitments and forgets about its responsibilities (von Foerster 1979).

Information on efficiency as an aspect of self-regulation

Self-regulation

Contact with the environment is regulated by the autopoietic system; the system determines when, what and through what channels energy or matter is exchanged with the environment (Maturana & Varela 1980). For example, the nervous system is organised (or organises itself) so that it computes a stable reality. This postulate stipulates "autonomy", that is "self-regulation", for every living organism. "Autonomy" becomes synonymous with the "regulation of regulation". This is precisely what the doubly closed, recursively computing torus does: it regulates its own regulation (see von Foerster 2003, 244).

Information

The environment contains no information; the environment is as it is (von Foerster 1984, 263). From the autopoietic perspective, systems are informationally closed. No information crosses the boundary separating the system from its environment. This radically alters the idea of the cybernetic feedback loop, for the loop no longer functions to connect a system to its environment (see Vanderstraeten 2001, 299). The relation between a thinking organism and its environment is only very rarely explicable in terms of direct causal links (see von Glasersfeld 2002, 6). Information and meaning in their broadest sense arise only from those self-organised systems which we call living, and which have a practical and historical relationship with the domain of the living (Brier 2008).

Cybernetic epistemology is, in essence, constructivist: knowledge cannot be passively absorbed from the environment; it must be actively constructed by the system itself. The environment does not instruct or "in-form" the system. The environment did not instruct the organism about how to build the model: the organism had to find out for itself (Heylighen & Joslyn 2001, 21). Furthermore, the inner state of the organism, its particular cognitive structures, its individual mental focus and interests, including its goals, had to be taken into account (von Glasersfeld 2002, 6).

When information is considered in a systemic context, it refers more to an "event" than to a "fact". Information changes the state of the system. Information is more of an experience than a fact. Information is the basic unit of an event in a system: this is not just data referring to facts, but information that affects people on a personal level. Only if information causes reactions (i.e. changes the state of the system) will it become a process element. Information is always information for a system (Luhmann 1995, 67, 69).

Efficiency

The problem of efficiency is to determine, at all levels of analysis, the cost of any particular element of performance and the contribution which that element of performance makes towards accomplishing the objectives. When these costs and contributions are known, the element of performance can be combined in such a way as to achieve maximum reduction. The problem of efficiency is to find the maximum of the production function, with the constraint that total expenditure is fixed (Simon 1997, 263–264). The theory should also say something about the technology that underlines the firm's production function, the motivations that govern the decisions of managers and employees or the processes that lead to maximising decisions (1997, 20).

According to Birnbaum (1988) teaching, research and services are each performed with the use of different technologies. Raw materials that need to be worked on differ, and they affect the technologies employed. The people applying the technology at the various institutions differ in terms of their preparation and skills. Institutions allocate their work effort differently (1988, 44–45). The technology of university production (of learning and scholarship) is unclear and highly idiosyncratic to the institution, the department and the individual professor (see Johnstone 2009).

Actual problems, as they present to the administrator, are always concerned with relative efficiencies, and no measure of absolute efficiency is ever needed. The theory does not require a numerical measure of efficiency, but merely a comparison of more or less between efficiencies of two alternative possibilities. Under these circumstances, the definitions of efficiency as a ratio of output to input and as a ratio of the actual to the maximum possible amount to the same thing (Simon 1997, 258). If two results can be obtained with the same expenditure, the greater result is to be preferred. Two expenditures of different magnitude can, in general, be compared only if they are translated into opportunity costs, that is, if they are expressed in terms of alternative results (p. 259). According to Simon (1997, 261), the work pace of workers cannot be considered as a valuationally neutral element—or else we would be led to the conclusion that a "speed-up" would always be eminently desirable.

If cost is measured in monetary terms, then the wages of employees cannot be considered as a valuationally neutral element, but must be included among the values to be appraised in the decision.

Perhaps the simplest method of approach is to consider the single member of the administrative organisation and ask what the limits are in terms of the quantity and quality of his output. These limits include (a) limits on his ability to perform and (b) limits on his ability to make correct decisions. To the extent that these limits are removed, the administrative organisation approaches its goal on high efficiency. Administrative theory must be interested in the factors that determine the skills, values and knowledge with which the organisational member undertakes his work. These are the "limits" to rationality, with which the principles of administration must deal (Simon 1997, 45–46).

Re-thinking the theoretical assumptions of self-regulation at universities

Researchers and teachers regulate their own regulation. Control is circular and controller and controlled are roles determined by an individual researcher and teacher. Researchers and teachers are autonomous. Their actions are in the service of their inner equilibrium. Moreover, contacts with different kinds of environments are regulated by researchers and teachers. They will respond to their environments in ways determined by their autopoiesis. To be renewed themselves, researchers and teachers actively seek new opportunities and try to utilise these opportunities. Essential features include self-selection, self-oriented activity, self-interest and build-in purpose. To self-regulate, the individual inner equilibrium, interest and evolution of researchers and teachers, including their goals, have to be taken into account.

Successful self-regulation needs information on efficiency, in other words, optimal use of resources. It is also important to know what skills, values, technologies and knowledge individual researchers and teachers will undertake in their work. Researchers and teachers in universities need information on their resources and an effective use of these resources. They need this kind of information to control their actions, to create order and to observe their performance. This kind of information on efficiency is defined through its impact. Information changes the states of researchers and teachers. Information is an experience, information that affects researchers and teachers on a personal level. It is only when this kind of information on efficiency causes reactions that it becomes a process element. This kind of information on efficiency is information for researchers and teachers.

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